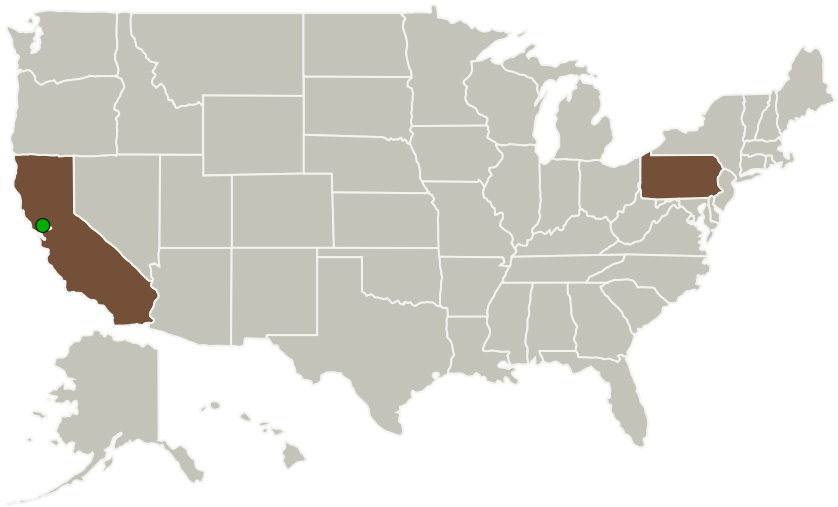
High-Quality Random Number Generation Software for High-Performance Computing, Phase I

Completed Technology Project (2012 - 2012)

Project Introduction

Random number (RN) generation is the key software component that permits random sampling. Software for parallel RN generation (RNG) should be based on RNGs that are good serial generators, but also are suitable for concurrent execution, i.e. RNs produced by different concurrent processes must be statistically independent of one another. With dependence, the work done on one concurrent process will be partially redone on another process, thus reducing the efficiency of the concurrent computation and defeating the purpose of concurrency. Although parallel RNGs exist for older parallel computing paradigms such as clusters, modern advances in computer architecture, specifically the hardware support for multithreading via multicore and other architectures, and widely available computational coprocessor technologies, such as the General Purpose Graphics Processing Unit (GPGPU) have created the need for high-quality RNG software to support these new architectural features. Thus, this Phase I research project addresses these new architectures from a mathematically rigorous stand-point of preventing statistical dependence and allowing for reproducibility in modeling and simulation as well as other applications. In addition, it investigates applications to small memory technologies such as embedded systems and radio-frequency identification (RFID) chips.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Daniel H. Wagner Associates, Inc.	Lead Organization	Industry	Exton, Pennsylvania
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Pennsylvania

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138530)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Daniel H. Wagner Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

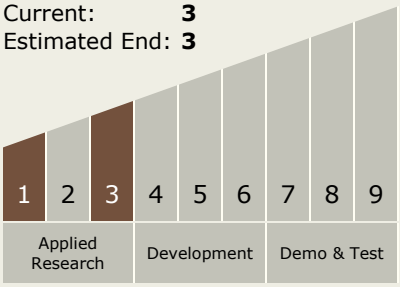
Carlos Torrez

Principal Investigator:

Timothy D Andersen

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.1 Software Development, Engineering, and Integrity
    - TX11.1.1 Tools and Methodologies for Software Design and Development

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System